U.S. BUREAU OF MINES, HELIUM PLANTS, EXELL HELIUM PLANT
Highway 287N
Masterson
Moore County
Texas

HAER TX-105-B
HAER TX-105-B

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD
SOUTHWEST SYSTEM SUPPORT OFFICE
National Park Service
U.S. Department of the Interior
PO Box 728
Santa Fe, NM 87504

HISTORIC AMERICAN ENGINEERING RECORD

U.S. Bureau of Mines, Helium Plants, Exell Helium Plant

HAER No. TX-105-B

Location:	Highway 287N, Masterson, Moore County, Texas
Date of Construction:	1942-43
Additional Construction:	Cryogenic Crude Helium Unit (1956), Carbon Dioxide Building (1956), Plant Headquarters (1986), Boiler Building (1986), New Warehouse (1986), Tank Car Shop (1986), New Generator Building (1986), Electricians and Welding Shops (ca. 1988)
Present Owner:	Bureau of Land Management, Department of the Interior
Present Use:	Closed (1998)
Significance:	The advances in helium technology developed at the Amarillo plant were implemented at Exell, the U.S. Bureau of Mines' principal helium producer from 1945 to 1998. Exell was the last of the government-operated helium plants to shut down after Congress passed the Helium Privatization Act in 1996.
Historian:	Christopher J. Huggard

Introduction

Beginning in 1917, the U.S. Navy began to understand the strategic implications of helium for use in dirigibles. The result was the formulation of the Helium Program, which resulted initially in the production of helium in a cryogenics laboratory in Washington, D.C. By the early 1920s, the Navy and the U.S. Bureau of Mines partnered to establish the Fort Worth, Texas, helium operation. Engineers and chemists soon developed the technology necessary for producing helium at a manageable cost through the cryogenic, or super cooling, production process. When the Petrolia Gas Field near Fort Worth was exhausted, Bureau of Mines officials, with the assistance of the Navy, decided to move the operation to Amarillo, Texas, near the Cliffside Gas Field and other helium-bearing natural gas wells.

Congress transferred complete control of the Helium Program to the Bureau of Mines in 1925 with passage of the Helium Conservation Act of 1925. The bureau moved its operations to the Amarillo plant, which, in 1929, began producing the highest quality helium to date.

The Exell Helium Plant did not come into operation until World War II, when the emerging military industrial complex and nuclear technology warranted new demands for helium. From the inception of the plant in 1942-43 until its closure in 1998 as a result of the Helium Privatization Act of 1996, the Exell plant served as the principal federal producer of helium.

The Exell Helium Plant and the Federal Helium Program, 1942-1998

The demands of World War II translated into a boom in helium production. As America's

inevitable entry into the war edged closer, President Franklin D. Roosevelt approved the construction of 200 new lighter-than-air craft and, in 1941-42, Congress appropriated more than $16 million to expand the Amarillo facility and construct new helium plants. Helium production figures jumped from just more than 9 million cubic feet in 1940 to 33 million cubic feet in 1942; 116 million in 1943; and 127 million in 1944. By war's end, the Bureau of Mines had designed and constructed four new plants – Exell, Moore County, Texas; Otis and Cunningham, Kansas; and Navajo, New Mexico – and expanded the Amarillo plant. The Helium Activity of the Bureau of Mines grew from one plant with thirty-six employees to four plants with more than 400 employees. The production level grew from about 9 million cubic feet of helium a year to nearly 140 million cubic feet a year. As the nation's top helium engineer, Clifford Seibel, put it: "With the handwriting on the wall, the helium operations of the Bureau of Mines, directed by 'Shorty' Cattell in Washington and by me in the field, went into high gear." Like so many other American industries during the war, the helium operations set monthly production records.

Construction of the Exell plant in Moore County, Texas (35 miles north of the Amarillo plant) was the crowning achievement of the World War II helium expansion program. The Bureau of Mines designed the plant with the most modern carbon dioxide removal system, purchased the 320-acre site for about $5,000, and then planned to build seventy-five employee homes there. Beginning in May 1942, C.C. Anderson, an Amarillo plant engineer, supervised construction of the facility; Stearns-Roger Manufacturing of Denver, Colorado, was the builder.

Due to wartime labor and material shortages, the bureau had to make numerous

adjustments to accelerate construction. It utilized two, seventy-two-passenger buses and semi-trailer trucks to transport workers from the Amarillo plant; modified equipment, such as rewiring electrical generators; and re-used pipe to insure rapid construction. Women played a key role in the construction, especially those employed at the Amarillo Machine Shop & Foundry, where much of the low-temperature equipment used to process helium was built.

Initial construction in 1942-43 called for twenty-seven buildings. Among them were major production-related structures such as the main office, and the separation, compressor, generator, and welding buildings. In addition, Stearns-Roger erected a cooling tower, the Employee Housing Camp (seventy-five homes), a change room, machine shop, boiler house, holding tanks, carbon dioxide removal units, garages, a loading dock, guard tower, and other lesser structures.

In addition, the Exell plant was equipped with ten helium separation units; eight natural gas compressors, five nitrogen compressors, and six helium compressors; three 2,300-volt generators driven by gas engines; two steam boilers; and two carbon dioxide removal units.

On March 13, 1943, Exell began processing helium, far out-producing the Amarillo plant from the start because of its modern technology. By June 30, 1944, Exell had produced 80,400,320 cubic feet of helium, or more than a third of the Amarillo plant's entire production of 220,442,557 cubic feet over a fifteen-year span. At $4.5 million, the government had expended more funds to put the Exell plant in operation than it had spent during the entire operation of the Amarillo plant ($3.2 million) from its inception in 1929. This expenditure reflected the

advancement in helium technology and the sheer size of the machinery put in place at Exell. Clearly, America's industrial strength was showcased at the modern plant, which still houses the gargantuan compressors installed during the war.

The Bureau of Mines designed and constructed three other helium plants during the war. Although they were not as large and productive as Exell, they made an important contribution to the overall production of helium during the war and postwar periods. The new plants – Otis and Cunningham in Kansas, and Navajo in New Mexico – were designed by Amarillo plant engineers and chemists, who included P.V. Mullins and W. M. Deaton. The Amarillo plant served as headquarters for America's helium operations. The Otis plant, constructed at a cost of $2.8 million, began operations on October 21, 1943, and produced 25,198,520 cubic feet of helium by June 30, 1944. Costing roughly the same, the Cunningham plant began operations on January 17, 1944, and produced 12,941,800 cubic feet of helium. The Navajo plant, with a construction cost of $3.5 million, operated only from March 9 to March 29, 1944, and produced 2,243,414 cubic feet of helium.

Helium played an important role in World War II. It was used in dirigibles that protected naval missions from submarines. Scientists at Los Alamos used it in the atomic bombs. Welders depended on helium to weld magnesium, aluminum, stainless steel, and a new metal – Titanium, which was used in rocket construction. Meteorologists, whose forecasts often determined when a mission would go forward, depended on helium-filled balloons to predict the weather. Helium also proved to be a life-giver in administering anesthetics and for soldiers suffering from

respiratory disease.

Faced with a lack of demand after the war, helium production rapidly declined, and every plant except Exell stopped production. During the postwar years, Exell became the principal helium-producing facility in the world. Not until the 1950s would the Helium Activity be revitalized and undergo some expansion. In the meantime, the Amarillo plant remained the center of research. In 1946, the Bureau of Mines established the Helium Research and Utilization Program, which refocused the Helium Activity from a program designed for wartime production to one for peacetime applications. A continued demand for helium resulted.

At the same time, because a purer helium was needed for a new welding technique, the Amarillo and Exell plants developed and implemented new technology – such as the activated charcoal filtering system that removed greater amounts of nitrogen – to improve helium purity from 98.2 percent to 99.995 percent (referred to as "welding grade" or Grade A). Consequently, the commercial demand motivated governmental advancement in technology.

In 1945, the Bureau of Mines initiated a helium conservation program. The Exell plant, which piped its processed helium to the Amarillo plant, pumped 20,629,400 cubic feet of helium (98 percent grade) into underground storage at Cliffside. This action not only initiated the government's helium conservation program, but also elevated the Exell plant to the No. 1 spot in helium production. As Exell became the principal helium producing facility, Amarillo virtually stopped production in the late 1940s and served as a research center, headquarters for the other plants, and as the principal shipping point for helium. It also was the location for reconditioning

cylinders used to transport and store the helium.

From 1947 through 1950, Exell produced virtually all the world's new supply of helium. During those four years, the plant produced nearly 270 million cubic feet of helium, with a high of 81,394,416 cubic feet in 1950, and a low of 55,165,482 in 1949. By 1950, the Bureau of Mines had pumped more than 80 million cubic feet of helium into the Cliffside underground storage for conservation. Much of this supply would be pumped out for use in the aerospace boom of the 1950s, which necessitated a more substantial conservation program beginning in 1962.

The bureau closed the Cunningham plant in 1945 and dismantled it, largely because of a diminishing gas supply at the site. Over the next three years, the bureau sent the Cunningham equipment and materials to Amarillo to update the plant there.

The decade of the 1950s proved to be a watershed for the Helium Activity. Not only did federal demand skyrocket, mainly because of the "race to space," but by the end of the decade the government, for the first time, called for private development of helium. As early as 1951, the Bureau of Mines called for expansion of its helium operations. Clearly, the Korean War renewed the demand for helium, a key component in the emerging military industrial complex. The Amarillo and Otis plants went back into production in 1951 and would remain so until the proliferation of private producers in the 1960s. During the 1950s, helium production more than quadrupled; since 1940 it had increased forty-fold.

A decline in warehoused helium was a clear indication of growing demand. Prior to 1952, the bureau annually pumped millions of cubic feet of helium into the Cliffside storage facility, a

deep, underground, former natural gas field sealed in dolomite for future consumption. By the early 1950s, more than 87 million cubic feet of helium was in storage. In 1953, the government began withdrawing helium from the reserve to meet national defense, weather, medical, and industrial demands. Less essential needs, such as gas for toy balloons, were not met.

This situation raised concern, and as early as 1953, the Budget Office of Defense Mobilization recommended that the Helium Activity be expanded. In its Annual Report for 1953, the Bureau of Mines stated that it was "reducing rather than augmenting its reserves for the future, which from the standpoint of conservation is not desirable . . ." Therefore, "additional facilities" were needed. In February 1954, Stone & Webster Engineering Corporation, hired by the Interior Department to evaluate the helium program, recommended construction of a new plant or expansion of the current ones. Congress responded later that year with a $6 million appropriation. The Bureau of Mines faced a choice: build a new plant or expand Exell. The bureau decided to do both, although completion of a new plant at Keyes, Oklahoma, was to wait three years. The immediate solution was to expand Exell from its 60 million cubic feet a year capacity to 150 million cubic feet.

America's race to space clearly warranted the expansion project at Exell. When the Russians launched Sputnik in 1957, the United States appeared to be trailing the Soviets in space-age technology. Thus, meeting demands for the space program was critical for the United States during the Cold War – and the Helium Activity would play an integral part. In 1954, the Bureau of Mines contracted with Quaker Valley Construction Company to complete the

modernization and expansion of Exell. In the end, the bureau expanded Exell, beginning in the fall of 1956. To assist in this expansion, the facilities at the Amarillo plant also were expanded: the laboratory (Building A) was extended to the south to include a new library and technical facility, and a new receiving and shipping dock (Building H7) was added. The Amarillo plant remained the principal administrative, research, accounting, and shipping and receiving headquarters for the Helium Activity, whereas the Exell plant, which often had an annual production in excess of its new 150-million-cubic-feet per year capacity, served as the foremost helium production facility in the world.

While the Exell plant was being expanded, the secretary of the Interior, with the cooperation of the Office of Defense Mobilization, recommended that the National Security Council adopt a national helium conservation program. Initially, the Bureau of Mines called for a 32.5 billion cubic feet conservation storage program, but by decade's end was arguing for a 56 billion cubic feet program. Even after the Exell expansion and completion of the new plant at Keyes, Oklahoma (Congress, in 1958, appropriated $12 million for the plant), the Bureau of Mines could not meet the growing demands for helium, especially the needs of the space and atomic energy programs. If current needs could not be met, how could the federal helium program meet future needs? Something had to be done, resulting in the Helium Conservation Act Amendments of 1960.

On the surface, the new conservation program appeared to be the solution for growing space age demands, as well as assurance of the long-term continuation of the Helium Activity

program. At the Exell plant, six larger separation units replaced ten World War II units and two more purification units were added, expanding production capacity in 1960 to 300 million cubic feet a year. The legislation, however, stimulated too much expansion in helium production – eight new private plants were built by 1968 – and served as the beginning of the end of the Helium Activity of the Bureau of Mines.

The production of helium leaped forward during the 1960s as the Cold War and a favorable economy fueled efforts to reach the moon, supply the Vietnam War, and advance nuclear energy. Helium was at every turn as efforts that began in the early 1950s to set annual production records continued into the mid-1960s. Bureau of Mines production steadily increased from 675 million cubic feet of helium in 1961 to a peak of 784.5 million cubic feet in 1966, after which it rapidly declined. Although the space program climaxed with the July 1969 voyage to the moon, by 1970 nearly all of the government plants, including Amarillo, ceased production. Only the Keyes and Exell plants continued producing. In 1974, Exell temporarily discontinued production as well. Government production figures for helium clearly indicate the downward trend: 769 million cubic feet in 1967; 645 million cubic feet in 1970; 306 million cubic feet in 1973; 297 million cubic feet in 1976; and 269 million cubic feet in 1979.

What caused this dramatic downturn in helium production? The most obvious reason was the rapid decline in the federal government's demand for helium. The National Aeronautics and Space Administration (NASA) had achieved its monumental goal of landing on the moon. The Atomic Energy Commission (AEC) had an ample supply for its activities. The Department of

Defense gradually was demobilizing as the Vietnam War came to a conclusion in the early 1970s, and the United States and Soviet Union were talking seriously about arms reductions. When these factors were added to down-spiraling economy, the outcome was a rapid decline in federal demand for helium.

Further hampering government production was a 1969 court ruling by the U. S. Court of Appeals for the District of Columbia, which ruled that federal contractors no longer had to purchase their helium from the Bureau of Mines. As a consequence, contractors began purchasing helium from private sources. By 1968, eight private helium-producing companies were operating in the gas fields of Texas, Oklahoma, Kansas, and New Mexico. Four of them had received generous, twenty-two-year contracts from the Department of the Interior to sell their helium to the government for conservation. These government purchases, in fact, were the core of the helium conservation program. While the bureau's plants – Amarillo, Exell, Keyes, Otis, and Navajo – were producing helium for the Air Force, NASA, the AEC, and other federal agencies during the 1960s, the private companies – Helex Company, Cities Service Helex, Inc., National Helium Company, and Phillips Petroleum – were selling millions of dollars of helium to the Bureau of Mines for storage in the Cliffside field near Amarillo. By 1980, the private firms had profited in the hundreds of millions of dollars by selling nearly 40 billion cubic feet of helium, pumped through the government-built 425-mile pipeline, to the Department of the Interior for storage at Cliffside.

From 1963 to 1969, the helium conservation program seemed to be working quite well.

As early as 1964, the Department of the Interior had purchased 2.6 billion cubic feet of crude helium from these private firms for $29.2 million. While privately produced helium was being stored at Cliffside, the Bureau of Mines' plants easily met federal demands. As federal demands increased in the mid-1960s, the Amarillo and Exell plants were modified to improve the purity of helium from "Grade A" (99.995 percent) to "High-Purity" (99.997 percent) by reducing the temperature of the charcoal purification units. The Bureau of Mines further improved Exell's performance in 1968-69, adding new instrumentation for remote monitoring and automatic control, and by replacing twelve small helium extraction units with one large unit to improve efficiency and production. In July 1969, when the Eagle landed on the moon and Astronaut "Buzz" Aldrin vented his helium tanks, the government's helium scientists were elated. But now that President John F. Kennedy's goal of reaching the moon was a reality, the Helium Activity program already was in decline and would be reduced to a mere shadow of its former self.

At the lowest point, the Department of the Interior ordered production to cease at the Amarillo plant on April 15, 1970, marking the end of forty-one years of continuous helium production there. Hundreds of Bureau of Mines' employees lost their jobs (reduced from nearly 650 employees in 1965 to 289 by 1971).

Not all was lost for Exell, however. The rapid depletion of the gas field at Keyes, Oklahoma, in the late 1970s and early 1980s meant a revival in production for the Exell plant. In 1979, the Bureau of Mines, under contract with CTI-Cryogenics (a division of Helix Technology Corp.), installed a 600,000 cubic feet cryogenic purifier and a 500 liter-per-hour liquefier to gear

up the plant for renewed production of helium. In 1978, the bureau had installed a helium liquefier at the Amarillo plant for shipment of liquid helium from Exell production. Then, in 1980, Hudson Engineering Company installed a 1.0 mmcf Pressure Swing Adsorption (PSA) purifier at Exell. In 1986, the bureau installed new carbon dioxide removal and nitrogen-drying units, which used a molecular sieve as an absorbing media. Because the carbon dioxide removal unit allowed Exell to process crude helium directly from the conservation pipeline, a new intake (with scrubbers) was installed from the Cliffside storage facility. Exell's lifespan was extended for at least another decade because of its proximity to the helium-rich natural gas fields of the Texas Panhandle. By this time, federal demand had dropped to about 200 million cubic feet of helium per year, meaning that Exell's 500 million cubic feet capacity could meet demand, however diminutive in relation to the past.

When the Keyes plant closed in 1981, the Exell plant produced 550 million cubic feet of "High Purity" and 115 million cubic feet of liquid helium. Despite the limited federal need for helium, government contractors and growing worldwide use boosted helium demand to more than a billion cubic feet a year. This spelled a dangerous trend for the Bureau of Mines' helium operations because private companies, once completely dependent on the Department of the Interior's conservation program for a market, now had alternative markets. Exell's annual production hovered at about 350 million cubic feet during the 1980s, when world demand exceeded 1 billion cubic feet and even reached 2 billion cubic feet by 1987. Ironically, it was that same year that the Annual Helium Report of the Minerals Yearbook, published by the Department

of the Interior, announced: "Privatization of the Government's helium program, except the conservation storage operation [which still purchased privately produced helium], is currently under consideration."

By 1989, twelve private helium companies were in operation, demonstrating a continued increase in demand. The technological applications of helium continued to increase during the 1980s and 1990s.

As the Clinton administration and Congress sought to reduce the federal deficit in the 1990s, the helium program came under heavy scrutiny, resulting in the Helium Privatization Act of 1996. Its justification included a debt of nearly $500 million built up by the federal helium program, as well as expansion of the private helium industry to eighteen plants owned by fourteen companies. Under the act, the Bureau of Mines was to cease helium production; give federal contracts for helium to private industry; and dispose of all facilities, equipment, and other real and personal property held by the United States for the production, refinement, and marketing of refined helium.

With this act, Congress ended eighty years of government production of helium. Currently, the Department of the Interior is in the process of shutting down its operations, which began as a kernel of an idea during the First World War to an incredibly advanced technological industry in the 1990s. It was the hard work and genius of government-trained and government-employed chemists, engineers, technicians, and general laborers who advanced the helium industry from a somewhat primitive technological program that produced 97 percent helium in the 1920s to a

sophisticated international industry that produced 99.999999 percent and higher grade helium for the world's most advanced aerospace, energy, and medical technologies. In the end, this Cooperative State program that took off during Herbert Hoover's era is now coming to a close with the benefits going to private companies that were able to cull the vast knowledge of helium extraction, processing, and production from the U. S. Bureau of Mines and its experts, who sustained the industry for most of the twentieth century.

Exell Technological Developments, 1960s-1990s

After the Helium Conservation Act of 1960, Exell became the principal helium producer in the world and remained so until passage of the privatization act in 1996. Even though the principles of cryogenically processing helium would not change, technological developments facilitated and increased production at Exell. The first major change came in 1968 when the bureau constructed a new control room and installed a new, automated instrumentation system. Originally approved in 1965, the Exell Instrumentation Project was completed in June 1968 by Taylor Instrument Companies for $752,000. The new instrumentation included nine control loops and 345 indicating instruments, "all with trend recording capability." In addition, the company installed colored light limit alarms for 168 of "the most critical indicators so an operator in the control room can scan the entire instrument panelboard and know immediately whether corrective action" was necessary. Designed to improve the plant's efficiency, the computerized system gave engineers the capacity to control production from one room. Significantly, and

indicative of the growing concern with costs, the bureau now could operate the plant with ten fewer employees, at a savings of $108,706. Eventually, the Helium Activity was able to eliminate twenty-five positions at an annual savings of nearly $175,000.

For the remainder of the Helium Activity's existence, Exell remained the principal federal helium production plant. Even as the role of the federal program declined (by 1980 there were fourteen private helium plants), the bureau continued to upgrade the Exell plant. In 1979, CTI-Cryogenics, a division of the Helix Technology Corporation, installed under contract a cryogenic helium purification unit and a 500 liter-per-hour liquefier. The following year the Hudson Engineering Company installed a 1.0 mmcfd Pressure Swing Adsorption unit, replacing the long-used activated charcoal adsorption first implemented in the late 1940s. In 1986, the bureau installed new carbon dioxide removal and nitrogen-drying units, which used molecular sieve as an absorbing media.

Bibliography

Anderson, C.C. "An Apparatus and Method for the Determination of Helium in Natural Gas." (I.C.6796). U.S. Bureau of Mines, June 1934.

_____. "Construction of Exell Helium Plant, Volume 1, History." U.S. Bureau of Mines, Department of the Interior, 1945. Amarillo, Texas: Helium Activity Downtown Headquarters.

Carlson, Paul H. Empire Builder in the Texas Panhandle, William Henry Bush. College Station: Texas A&M Press, 1996.

Cattell, R. A. "Helium: The Wonder Gas." The Scientific Monthly 69:4 (October 1949): 222-228.

_____. "War Work of the Helium Section of the Petroleum and Natural Gas Division."

Bureau of Mines, Department of the Interior, 1945. Amarillo, Texas: Administrative Office Building Files (Building D), Amarillo Helium Plant.

"Chronology of Helium Program." Office of Assistant Director Helium Activity, Bureau of Mines, July 1, 1969. Amarillo, Texas: Administrative Building Files, Amarillo Helium Plant.

Deaton, W.M. to C.W. Seibel, January 8, 1946. College Park, Maryland: National Archives, Record Group 70, Box 5234.

Derrickson, Jehu R., Formed Steel Tube Institute, to Harold Kennedy, Helium Liaison Branch, Department of the Interior, 1955. College Park, Maryland: National Archives, Record Group 70, Box 87.

Erlandson, George E. to H.S. Kennedy, August 23, 1949. College Park, Maryland: National Archives, Record Group 70, Box 6127.

Ferguson, J.W. to H.S. Kennedy, February 26, March 22, 1946. College Park, Maryland: National Archives, Record Group 70, Box 5234.

Fox, J.H., Air Reduction Sales Company, to H.S. Kennedy, July 12, 1956. College Park, Maryland: National Archives, Record Group 70, Box 99.

Frick, C.C., Cramet, Inc., to H.S. Kennedy, July 15, 1955. College Park, Maryland: National Archives, Record Group 70, Box 87.

Frost, E.M., Jr. "Improved Apparatus and Procedure for the Determination of Helium in Natural Gas." (R.I. 3899), U.S. Bureau of Mines, June 1946.

"Helium Becomes a Heavyweight." Chemical Week (November 28, 1953): 77-79.

"Helium Handling in Texas, Underground Storage and Feature of High Pressure Transport Line." American Gas Journal (May 1945): 49, 69.

Helium Policy Working Group. "Report of Subcommittee III" (1957). College Park, Maryland: National Archives, Record Group 70, 111.

Huggard, Christopher J. "The History of Helium," in National Park Service, History and Historic Structures Inventory of The Amarillo Helium Plant and Exell Helium Plant, 1928-1996. Amarillo, Texas: Bureau of Land Management, 1999.

Interagency Helium Committee. "The Magnitude and Importance of Future Helium

Requirements and Alternatives for Supplying Projected Demand, Report of Investigation of Helium Program," vol. 2 (H.R. 7636). Department of the Interior, Department of Defense, Department of Energy, National Aeronautics and Space Administration, January 31, 1978.

Jackson, William G. "World's Longest 2,500-Psi Line." Gas (May 1947): 37-41.

Seibel, C.W. to R.A. Cattell, October 28, 1940. College Park, Maryland: National Archives, Record Group 70, Box 3627.

Seibel, Clifford W. Helium, Child of the Sun. Lawrence: University Press of Kansas, 1968.

_____. "Production of Helium at Amarillo," 30:8 (August 1938): 849-852.

_____. Handwritten trip report. (September 24, 1945). College Park, Maryland: National Archives, Record Group 70, Box 4663.

Stewart, Andrew. "About Helium" (I.C. 6745). Bureau of Mines, Department of the Interior, September 1933.

Stone & Webster Engineering Corporation. "Report on Helium for the Bureau of Mines." Washington, D.C., February 4, 1954.

U. S. Bureau of Mines, Department of the Interior. Annual Reports, Amarillo Helium Plant, 1936-1951. Amarillo, Texas: Administrative Building Files (Building D), Amarillo Helium Plant.

_____. Helium Activity, Annual Reports, 1961-1970.

_____. "Justification for Actions Requested in Connection with the Construction of New Buildings at the Amarillo Helium Plant," April 16, 1947. College Park, Maryland: National Archives, Record Group 70, Box 5522.

_____. "Helium," in Minerals Yearbook, 1952-1970, 1976-1994. Washington, D. C.: Government Printing Office, 1952-1996.

_____. "Helium, A Report for the Secretary of the Interior," December 15, 1955 (classified). Amarillo, Texas: Amarillo Helium Plant.

_____. "Specifications for the Completion of an Addition to the Exell Helium Plant, Exell, Texas." Amarillo, Texas, 1956.

U. S. Congress. "Helium Act Amendments of 1960." S.R. 1814, H.R. 1552, accompanying H.R. 10548, April 26, June 30, 1960.

_____. "Helium Conservation: An Ideal Program, Extension of Remarks of Hon. Walter Rogers of Texas in the House of Representatives," 87th Cong., 2nd sess., September 24, 1962.

_____. "Helium Privatization Act of 1996." H.R. 4168, P.L. 104-273. 104th Cong., 110 Stat. 3315, October 9, 1996.

_____. "Amarillo Helium Plant." H.R. 102000. Hearings Before the Committee on Mines and Mining. 71st Cong., 2nd sess., April 29, May 13, 16, 20, 23, 24, 1930. Washington, D.C.: Government Printing Office, 1930.

_____. "Conservation of Helium Gas." H.R. 4415, H.R. Hearings Before the Committee on Military Affairs. 75th Cong., 1st sess., April 20, 21, 22, May 27, June 29, 30, July 1, 1937. Washington, D.C.: Government Printing Office, 1937.

_____. "Hearings Before the Subcommittee on Mines and Mining." H.R. 10548. Committee on Interior and Insular Affairs, February 19, March 10, 11, June 1, 15, 1960. Washington, D. C.: Veley Reporting Co., 1960.

U. S. Department of the Interior. "Review of Helium Program, Final Brief," September, 1970.

U. S. Secretary of the Interior. "Helium-Bearing Gas Lands in the Navajo Indian Reservation, New Mexico." 80th Cong., 1st sess., House Doc. No. 212, April 17, 1947.

_____. "Reports to the Congress on Matters Contained in the Helium Act, 1961-1988," (P.L. 86-777). Amarillo, Texas: Administrative Building Files (Building D), Amarillo Helium Plant.

U.S. Secretary of the Interior to Director, U.S. Bureau of Mines, July 8, 1955. College Park, Maryland: National Archives, Record Group 70, Box 87.

Wheeler, Henry P., Jr. to C.W. Seibel, "Helium Purification with Charcoal," May 5, 1948. College Park, Maryland: National Archives, Record Group 70, Box 5234.